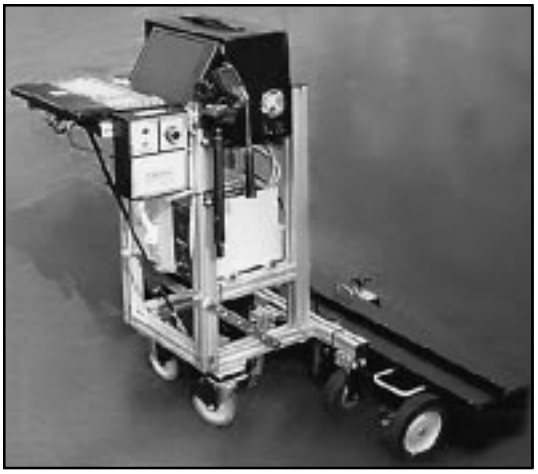
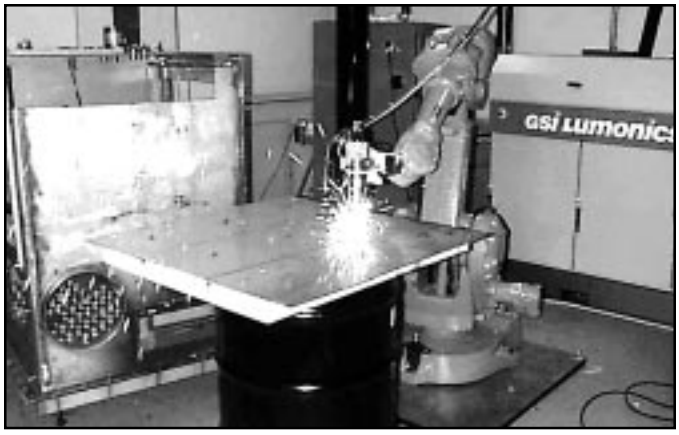
Deactivation and Decommissioning Focus Area

QUARTERLY REPORT – JANUARY 2001

October – December 2000 Activities





Office of Science & Technology

NETL

D&D Focus Area

On the Cover

Clockwise from Upper Left:

The **Surface Contamination Monitor** for characterization of large areas is in use at the Nevada Test Site.

The Fernald team is deploying the **Universal Demolition Processor** for removal of concrete and segmenting steel plate.

At FEMP, an **Oxy-Gasoline Torch**, used for the accelerated cutting of carbon steel, is one of three significant technologies used in Integrated Decontamination and Decommissioning.

TRU Waste Laser Cutting at the Nevada Test Site will reduce the size of TRU-contaminated metal boxes prior to shipment to WIPP.

The purpose of this document is to provide an overview of the Deactivation and Decommissioning D&D Focus Area and to update readers on the program's current activities. It presents a synopsis of the current program status and recent accomplishments, along with overviews of planned activities, program issues, and opportunities. Quarterly reports are distributed to U.S. Department of Energy DOE headquarters and operations office managers, site personnel, site operating contractors, technology developers, principal investigators, regulators, and other stakeholders. Issued in January, April, July, and October, the D&D quarterly reports summarize the activities of each preceding quarter. The D&D Update is published in all other months, introducing new projects and highlighting advances in ongoing projects. Quarterly reports, monthly updates, and further information about the D&D Focus Area DDFA are found on the World Wide Web at *www.netl.doe.gov/dd*. Technologies are usually identified by their discrete tracking numbers within the Technology Management System TMS operated by DOE's Office of Science and Technology OST. Providing access to information about OST programs, technologies, and linkages to EM problems, TMS is found on the World Wide Web at *ost.em.doe.gov/tms/home/entry.asp*.

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1.0 HIGHLIGHTS

U.S./Russian Workshop Shares Technologies on Tritium and Plutonium Decontamination

Under the auspices of the Joint Coordinating Committee for Environmental Restoration and Waste Management (JCCEM), two United States-Russian decommissioning workshops were held in Miamisburg, Ohio, during the week of December 11, 2000.

Information on technical approaches and technologies was exchanged between representatives from Princeton Plasma Physics Laboratory, Hanford, Savannah River, Idaho National Engineering and Environmental Laboratory, Los Alamos National Laboratory, Rocky Flats, Lawrence Livermore National Laboratory, Mound and the Russian representatives.

On December 11-12, 2000, a workshop was held on decommissioning tritium-contaminated facilities. Presentations and discussions were given on completed and ongoing Tritium D&D Projects in the DOE complex. Promising technologies for decontamination, treatment of contaminated liquids, treatment of air, waste disposal, as well as health effects of tritium were presented.

On December 13-14, 2000, a workshop was held on decontamination of plutonium-contaminated gloveboxes and other equipment. Many of the U.S. representatives discussed a common problem at several U.S. sites, the accumulation of plutonium-contaminated gloveboxes. During the workshop, the DOE sites needs in the area of decontamination, handling, and size reduction were identified. Several technologies were presented for the decontamination of the gloveboxes including soft media blasting and strippable coatings.

As a result of the two workshops:

- The U.S. representatives will provide, through official JCCEM channels, more details on the DOE sites where the Russian technologies may have applications. The correspondence will identify the sites and their specific problems and will solicit proposals from the Russian side.
- Based on the information presented from the U.S. representatives during the workshop, the Russian side will identify additional Russian-developed technologies with potential applications to DOE site needs. These technologies should be presented in a JCCEM proposal format through standard JCCEM channels.
- The U.S. and Russian sides will explore the possibility of exchanging information on the results of monitoring contamination/migration in the environment, regulatory standards of contamination, and monitoring methodologies.
- The U.S. and Russian sides will explore possible workshop(s) on the following topics:
  - Project management
  - Stakeholder/public interaction
  - Transfer of buildings, land, and property for private sector use
  - Contracting for environmental remediation work

In September 1990, DOE and the Ministry of Atomic Energy for the Russian Federation (MINATOM) signed a Memorandum of Cooperation (MOC) in the Areas of Environmental Restoration and Waste Management under the umbrella of the Peaceful Uses of Atomic Energy Agreement of 1972 between the U.S. and Russian governments.

Steve Bossart (DOE-NETL) and Evgeny Krukov (MINATOM) concluded the US/Russian Tritium Workshop by signing the Record of Meeting.

In November 1990, DOE and MINATOM established a JCCEM to oversee and manage the activities conducted under the MOC. The NETL's Deactivation and Decommissioning Focus Area (DDFA) manages the decontamination and decommissioning (D&D) aspects of the MOC. Several of the technologies discussed by the Russians offer potential advantages over DOE's baseline D&D technologies and could be demonstrated in the DDFA's Large-Scale Demonstration and Deployment Program.

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Technology Deployment for Asbestos Destruction

Objective and Scope: Asbestos Recycling Incorporated (ARI) was awarded a firm fixed price contract to process 10,000 pounds of asbestos-containing material (ACM) from the Savannah River Site. ARI's thermochemical treatment unit (TCCU) consists of modular components designed for hazardous waste treatment. The system will be used to remineralize asbestos resulting in non-toxic, non-regulated, asbestos-free aggregate suitable for recycling. The modular systems include a waste pretreatment system, rotary hearth, off-gas processing system, and a product-handling system. These systems are designed to accommodate a variety of waste types and contaminants.

Status and Accomplishments: The contract was awarded to ARI on September 30, 2000. On October 20, the National Energy Technology Laboratory held a project kick-off meeting that included a presentation from ARI describing the technology to be used, the scope, schedule, and other pertinent aspects of the project.

Current Reporting Period Activities: In early October 2000, ARI coordinated with John Pierpoint at DOE's Savannah River Site and with DOE's asbestos abatement contractor to arrange for abated asbestos to be picked up by ARI's selected trucking contractor. ARI contracted with Freehold Cartage, Inc., Eutawville, South Carolina to pick up the asbestos and transport the material to ARI's facility located in Tacoma, Washington. During this time, ARI also secured a permit from the Puget Sound Air Quality Agency that allows temporary storage of the asbestos pending the issuance of a final and permanent permit.

The asbestos was loaded onto the Freehold Cartage truck on Wednesday, October 18, 2000 and was transported without incident to Tacoma on Monday, October 23. The asbestos (i.e., 441 bags) was unloaded into a steel shipping container, which was then properly labeled and locked. The asbestos will remain in storage until processed.

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> "The system will be used to remineralize asbestos resulting in non-toxic, non-regulated, asbestos-free aggregate suitable for recycling."

2.0 Project Summary Table

The following table summarizes the Technical Task Plans for the D&D Focus Area Core Program and related Crosscutting and Industry Program contracts. Project descriptions follow in subsections 2.1 through 2.5 and are organized by the work breakdown structure WBS element listed here.

Project Number	D&D WBS Element	Project Name	Page
AL08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Los Alamos National Laboratory Transuranic Waste	7
OH08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Mound Tritium Facilities	8
ID08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Idaho National Engineering and Environmental Laboratory Fuel Storage Canals and Underwater and Underground Facilities	11
RL08DD21	Demonstrations and Industry Approaches	Canyon Disposition Initiative	12
SR09DD61	Demonstrations and Industry Approaches	Highly Selective Nuclide Removal System—Accelerated Site Technology Deployment	13
OH19DD61	Demonstrations and Industry Approaches	Mobile Work Platform—Accelerated Site Technology Deployment	14
RL09DD61	Demonstrations and Industry Approaches	Remote Size Reduction for Large Hot Cell Deactivation—Accelerated Site Technology Deployment	15
AL08SD10	Demonstrations and Industry Approaches	Los Alamos National Lab Decontamination and Volume Reduction System—Accelerated Site Technology Deployment	—
NV09DD61	Demonstrations and Industry Approaches	Oversize Transuranic Waste Laser Cutting System, Nevada Test Site—Accelerated Site Technology Deployment	16
OH19DD62	Demonstrations and Industry Approaches	Personal Ice Cooling System—Accelerated Site Technology Deployment	16
ID08SD11	Demonstrations and Industry Approaches	Integrated Decontamination & Decommissioning—Accelerated Site Technology Deployment	17
CH	Demonstrations and Industry Approaches	Smart 3-D Characterization of the Brookhaven Graphite Research Reactor (BGRR)	19
RF09D21 RF08SD10 RF09DD61	Demonstrations and Industry Approaches	Rocky Flats Environmental Technology Site—Accelerated Site Technology Deployment and the D&D Initiative	20
OH	Demonstrations and Industry Approaches	Diamond Wire Saw Demolition and Size Reduction of a Reactor Bioshield—Accelerated Site Technology Deployment	22

2.1 Demonstration and Industry Approaches

LANL TRU Waste Characterization, Decontamination and Disposition LSDDP

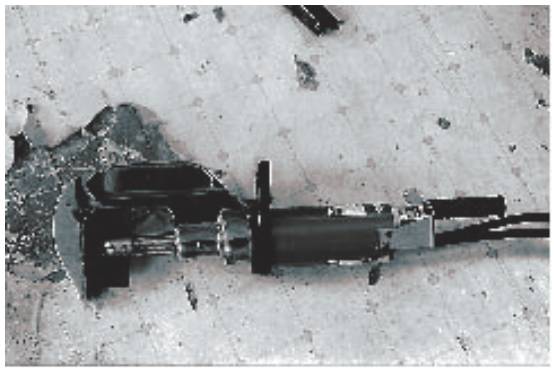
Objective and Scope: The Los Alamos National Laboratory (LANL) TRU Waste Characterization, Decontamination and Disposition Large Scale Demonstration and Deployment Project (LSDDP) addresses the characterization, decontamination and volume reduction of oversized metallic transuranically contaminated (TRU) waste currently in storage at LANL's storage and disposal area, TA-54. The LANL LSDDP reflects the cooperative interest of industry, government, and academia to bring collaborative expertise and strength to DOE's TRU decontamination and decommissioning program at LANL and elsewhere within the DOE complex. LANL currently has 1,500 m^3 of TRU waste in inventory, 313 plutonium-contaminated gloveboxes in a 24,000 ft^2 facility, and expects to generate another 2,500 m^3 from ongoing operations in coming years.

The major objectives of this LSDDP are to:

- Identify technologies that are ready for deployment for the characterization, decontamination and volume reduction of TRU waste/TRU contaminated metallic objects.
- Identify technologies that are ready for demonstration.
- Demonstrate those technologies with potential to reduce cost, risk and schedule and that are amenable for direct field application at Los Alamos and elsewhere in the DOE complex.
- To the extent possible, compare technologies "side by side" with baseline approaches to evaluate their advantages (cost, risk, schedule) and refine/validate baseline assumptions.
- Capitalize on the combined corporate management and technical strength of private industry, government and academia.
- Demonstrate a leveraged funding pool of federal and private monies via cost sharing to address issues of national importance.
- Provide ready access to demonstration results through an aggressive communication program.

Crates of plutonium-contaminated gloveboxes stored at Los Alamos National Laboratory (LANL) are destined for permanent disposal at the Waste Isolation Pilot Plant (WIPP)

Status and Accomplishments: The LANL LSDDP has demonstrated the following five technologies to date: the AeroGo air pallets, the SAIC Vehicle and Cargo Inspection System (VACIS) for RTR of crates, the Mobile Characterization Services transportable X-Ray for RTR of crates, the Nukem RASP for sectioning gloveboxes, and the Mega-Tech hydraulic cutter.



Mega-Tech Blade Plunging Cutter at LANL LSDDP at the FIU-HCET

Current Reporting Period Activities: The Mega-Tech Blade Plunging Cutter was demonstrated late September–early October to remove unistrut and 3-inch diameter pipe legs from plutonium gloveboxes. Based on processing two gloveboxes per week for a year, the Blade Plunging Cutter from Mega-Tech Services reduced cost by about five percent and resulted in reductions of airborne particulate, noise, vibration, and fire and explosion hazards compared to the baseline technology, a reciprocating saw. The safety assessment was performed by the

International Union of Operating Engineers. The Blade Plunging Cutter cut pipe legs in 40 percent less time than a reciprocating saw. The Blade Plunging Cutter uses a hydraulically driven, 4-inch blade to sever glovebox legs in a guillotine fashion. Based on its higher production rate, cost effectiveness, and enhanced safety features, the Blade Plunging Cutter is expected to be used to remove legs and other appurtenances from surplus contaminated gloveboxes at the DOE sites such as LANL, Rocky Flats Environmental Technology Site, and Hanford.

The NT Vision System was demonstrated, in September-October 2000, to make video recordings of low-level radioactive waste (LLW) materials being placed into containers. The camera of the NT Vision System was placed above the containers and videotaping was automatically started when differences appear between consecutive frames. The NT Vision System also highlights the differences between frames to reveal the items that enter the optical field of the camera. In the LANL LSDDP, the NT Vision System was used to record placing of plywood and other LLW into waste containers. The plywood and LLW came from two breached fiberglass-reinforced plywood crates containing plutonium gloveboxes and other suspect transuranic metallic waste. The NT Vision System provided permanent documentation of the materials placed in the containers. It also revealed that two materials were inadvertently placed in the containers that pose mixed waste issues (i.e., batteries and caulk tubes). These materials were retrieved before closing the containers. As a result of the successful demonstration, LANL plans to deploy the NT Vision System to provide permanent documentation on the contents of its TRU and LLW containers.

For more information:

http://www-emtd.lanl.gov/LSDDP/DDtech.html

Tech ID 2203

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▼Mound Tritium D&D LSDDP

Objective and Scope: The Mound Plant in Miamisburg, Ohio began operations in 1948. The site's mission, originally to fabricate the neutron initiator for the atomic bomb, expanded to include research, development, and production of numerous nuclear and non-nuclear weapons components, production of radioisotopically fueled thermoelectric generators and surveillance of nuclear weapons components.

The objective of the Mound Tritium D&D LSDDP is to identify, demonstrate and evaluate innovative technologies applicable to the decontamination and decommissioning (D&D) of tritium facilities. D&D of Mound's surplus tritium facilities, the T and R/SW Buildings, provides a unique opportunity to compare, evaluate, and eventually execute innovative D&D technologies alongside baseline technologies in an ongoing project. The Mound LSDDP will identify and explore methods to improve worker safety while achieving cost and schedule savings. The project is expected to identify technologies that, when implemented in the Mound LSDDP, will produce significant savings on the $57.8 million baseline. The results and successes of this demonstration project will benefit similar DOE facilities and projects.

The Mound Plant, Miamisburg, Ohio commenced operation in 1948.

The Technical (T) Building is an underground reinforced-concrete structure built in 1948 for the purification of polonium-210

used in nuclear weapons initiators. Later the facility was used to extract other radionuclides, house the plutonium verification facility, and store TRU materials. Facilities large enough to handle multikilogram quantities of tritium were added to the building. Current plans are to decontaminate T Building to potentially allow unrestricted public reuse by the year 2003. The SW Complex and one corridor of rooms in the adjacent R Building form the SW/R Complex. Four types of operations have been performed in these facilities to support nuclear weapons programs using tritium: component development, component evaluation operations, tritium recovery, and material analysis. To meet DOE's vision of completing the environmental restoration of the site by 2005, the SW/R Tritium Facilities will be demolished, and contamination beneath the building will be removed.

It is anticipated that innovative technologies will be applied to the following decontamination tasks:

- tritium-contaminated gloveboxes
- tritium characterization techniques
- productivity improvement technologies
- tritium specialties decontamination
- piping system removal and disposition
- mixed waste treatment and disposal
- tritiated water treatment
- contaminated water plume under SW building
- miscellaneous rad/non-rad traditional building materials disposition

The Mound LSDDP IC Team includes Babcock & Wilcox of Ohio, Lawrence Livermore National Laboratory (LLNL), British Nuclear Fuels Limited (BNFL), Foster Wheeler, IT Corp, Los Alamos National Laboratory (LANL), Westinghouse Savannah River, Princeton Plasma Physics Laboratory (PPPL) and Florida International University (FIU).

Status and Accomplishments:
Completed Demonstrations:

1. Portable Scintillation Counter (Tech ID 2311): The Lumi-Scint portable scintillation counter is a portable, single-tube liquid scintillation counter that can be set to respond to the low-energy beta radiation from tritium. It uses a single photomultiplier tube and manual sample chamber. The Lumi-Scint can be run from an internal battery or 110 VAC for its operation. The unit can be obtained with a printer, which allows hard copies of its electronically stored data.

2. Water Solidification (Tech ID 2312): This technology uses polymer-based absorbent (Waterworks SP-400) that can be used to solidify aqueous waste. It is similar to other polymer-based absorbents that offer benefits over traditional solidification agents such as cement or the Mound facility baseline solidification agent, Aquaset. Benefits include: a high liquid-to-absorbent ratio; no mechanical mixing required to promote the absorption process; little to no volume increase in the waste form after addition of the absorbent; and a very high retention in the form of the gel-like material.

3. Oil Solidification (Tech ID 2313): This contaminated oil solidification technology—NOCHAR PetroBond®— is a high-quality polymer offered by NOCHAR®, Inc., of Indianapolis, Indiana, and is specifically designed as a petroleum-based liquid absorbent. The PetroBond® absorbs very quickly with little increase in volume. The PetroBond® can be used for free-liquid control in storage, transport, and disposal of low-level radioactive waste.

The Tritium Clean-Up Cart was demonstrated as part of the Mound LSDDP

4. Tritium Clean-Up Cart (Tech ID 2974): The Tritium Clean-Up Cart is a portable, tritium Processing System Clean-Up Cart. Used as a stand-alone cart for scrubbing tritium effluent, it provides a scrubbing process based on catalytic oxidation of tritium. Tritiated water is collected on removable molecular sieve dryers, which can be ship-ped as low-level waste below the 1080 curie "Type A" limit. The unit provides a projected decontamination factor of greater than 1000, with a process flow rate of 45 l/min. Design features include: mole sieve dryer beds configured in series with moisture monitors to prevent moisture breakthrough; process flow controllers in

the main plumbing loop and air inlet system; process thermocouples, which provide process stream and enclosure over-temperature control; and an enclosure that can function as a ventilated hood during normal operating conditions, but can be isolated when tritium concentrations inside the enclosure exceed the pre-selected control setpoint.

5. Pipe Cutting and Crimping System (Tech ID 2955): The Pipe Cutting and Crimping System is a small hand-held, battery-operated crimping tool manufactured by Burndy Products. This tool uses a separate hydraulic pump with a high-pressure hose connected from the pump to the crimping head. U-shaped dies are contained in the head for crimping. A battery-powered hydraulic pump or electric-powered pump can be used to develop 10,000 psi of pressure to the crimping head. A total of 30 crimping operations can be performed before recharging is needed. The small dimension and lightweight make this tool very suitable for crimping in tight quarters.

6. Barter Process Demonstration: The Barter Process Demonstration is to demonstrate the potential savings to Mound of a bartered sale agreement and contaminated equipment transfer to a commercial company, with support being provided from DOE-Ohio and the National Metals Recycling Center.

7. TechXtract® Chemical Decontamination (Tech ID 1450): TechXtract® is a contamination extraction technology that utilizes chemical formulations to remove contaminants from matrix surfaces and sub-surfaces. Different chemical formulations are used for removal of specific contaminations from metal and/or concrete surfaces and sub-surfaces. In this demonstration, the technology was successfully demonstrated to decontaminate volumetrically contaminated stainless steel equipment. The demonstration showed greatly improved decontamination efficiency compared to the baseline method of decontamination using hydrogen peroxide.

8. Heavy Metals Removal from Mixed Waste Oils Using SAMMS: The SAMMS technology was developed by the Pacific Northwest National Laboratory (PNNL) for removal and stabilization of RCRA metals (i.e., lead, mercury, cadmium, silver, etc.) and for removal of mercury from organic solvents. The SAMMS material is based on self-assembly of functionalized monolayers on mesoporous oxide surfaces. The unique mesoporous oxide supports provide a high surface area, thereby enhancing the metal-loading capacity. SAMMS material has high flexibility in that it binds with different forms of mercury, including metallic, inorganic, organic, charged, and neutral compounds. It removes mercury from both organic wastes, such as pump oils, and from aqueous wastes.

Current Reporting Period Activities: In the current period, the project initiated two new demonstrations. The first is E-PERM® to measure tritium contamination on surfaces and in the air. The E-PERM® (Electret-Passive Environmental Radiation Monitor) is a commercially available instrument and its technology is designed to provide faster and less expensive means of determining the tritium contamination in air and on solid surfaces. An electret is a dielectric material that can retain an electrical charge almost indefinitely. Airborne tritium either in the form of gas or in the form of tritiated water vapor emits ionizing radiation, which lends itself to measurements with electret ion chambers. Since tritium poses special problems in detection due to its very low energy beta radiation and a range of ~4 mm in air, the E-PERM® electret ion chamber technology provides for an innovative technique for the characterization of tritium. The E-PERM® tritium monitoring system consists essentially of three components: 1) a passive integrating ionization chamber made of electrically conducting thin wafers of polypropylene with volumes ranging from 1 cubic centimeter to approximately 1000 cubic centimeters; 2) an electret which is a very stable electrically charged Teflon“ disk and serves as both a source of an electrostatic field and a sensor inside the ionization chamber; and 3) a portable, battery powered, microprocessor-operated electret voltage reader and data logger.

For measurement of airborne tritium, the E-PERM® monitor uses a chamber made of carbon filled polypropylene and the window is made of thick carbon coated Tyvek“ material, which is highly transparent to water vapor. For tritium surface monitoring, the E-PERM® system is used in a windowless

mode. A mesh, supplied by the manufacturer, is used over the surface of a contaminated object before deploying the electret ion chamber to prevent contamination of the chamber.

The second demonstration initiated during the current period is Waste Isolation Composite (WIC). WIC is an ultra-high-strength composite material with high durability and low permeability that can be used for isolation or encapsulation of high-activity tritiated liquids. This is especially useful for disposal of liquid waste with high curie content tritiated water.

Fiber Optic Tritium Detector and Quantifier (Tech ID 2956): This technology developed by McDermott Technologies, Inc. uses a fiber optic bundle coupled to a photomultiplier tube detector to measure low energy beta radiation from radioactive decay of tritium. It allows the fiber bundle to be introduced directly in the liquid (oil or water) sample for tritium detection and quantification. This technology is currently being demonstrated. Status will be updated in future reports.

For more information:

http://www.doe-md.gov/lsdd/lsdd.htm

Tech ID 2201

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▼INEEL Fuel Storage Canals and Associated Facilities D&D LSDDP

Objective and Scope: The Idaho National Engineering and Environmental Laboratory (INEEL) Fuel Storage Canals and Associated Facilities LSDDP is led by an IC Team consisting of Parsons Engineering, BNFL, BBWI, TLG Engineering, FIU, and Idaho State University. This LSDDP will utilize funding, technologies, and expertise from the Offices of Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization; industry; universities; and the international community.

The project includes the following areas:

- Test Reactor Area TRA-660, housing two underwater research reactors, the Advanced Reactor Measurement Facility and the Coupled Fast Reactivity Measurement Facility, with a 30,000-gal interconnecting water canal that was sometimes used for fuel storage. These facilities were utilized for reactivity insertion experiments that were later scaled up for experiment design in larger reactors. The two reactors achieved criticality in 1960 and 1962, respectively. Neither has operated since February 1991. Contamination includes radioactive elements, lead, and chromium.
- TRA Filter Pit system, consisting of five structures containing large filters associated with test reactor operations. The facilities are contaminated with lead, radioisotopes, and deteriorating asbestos. The filters are located in restricted entry pits, and D&D work will have to be done remotely and in confined spaces.
- Test Area North TAN-620 Initial Engine Test Control Room, a massive underground, shielded, heavily reinforced concrete structure that served as the control center for the engine tests in the Aircraft Nuclear Propulsion Program conducted at the INEEL in the late 1950s and 1960s. Contamination includes asbestos, mercury, lead, and some potential radiation.

This LSDDP is a high priority for the DOE/Commercial Nuclear Utilities D&D Consortium, with demonstrated technologies having deployment opportunities in the nuclear utility market through the consortium. Resulting deployments throughout the DOE complex alone could generate a potential cost savings and mortgage reduction of $20 million.

Eleven to 18 innovative and improved technologies will be demonstrated in the areas of underwater inspection, characterization, and dismantlement; inspection, characterization, and dismantlement in restricted spaces; recycle of materials from D&D activities; removal of loose radiological contamination on walls,

floors, piping, and equipment; removal of fixed radiological contamination on concrete; tank, vessel, and piping decontamination; lead plate radiological decontamination; and high-radiation exposure fields.

Status and Accomplishments: The Russian technology is currently awaiting release by the government authorities for shipment to the United States.

Current Reporting Period Activities: INEEL is currently working with DOE and the Research and Development Institute of Construction Technology (NIKIMT) in Moscow, Russia, to demonstrate a Russian technology. The technology is a non-tethered 3D-Gamma Locator Device (GLD) that provides three-dimensional characterization of radioactivity in areas of high level radioactivity.
A robotic unit provides results to a computer-based control system. The first phase testing of the technology was successfully accomplished, during an earlier period, in Russia. Work is proceeding to bring this technology, with an isotopic analyzer, to the INEEL for demonstration in mid-January 2001.

For more information:

http://id.inel.gov/lsddp/

Tech ID 2202

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▼Canyon Disposition Initiative

Objective and Scope: The Hanford Canyon Disposition Initiative (CDI) Project is a collaborative project that initially included participation across the DOE Office of Environmental Management (EM). Participating EM offices included the Offices of Waste Management Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization. This partnership was driven by the broad and significant impact that

decisions made on the disposition of the canyons would have to all of these programs. Due to the reorganization of EM in September 1999, CDI is being overseen by the newly created Office of Project Completion.

The CDI Project is evaluating the feasibility of using the five chemical processing facilities (canyons) as assets for disposal of low-level wastes, instead of a mortgage liability. The 221-U Facility is being used as a pilot for this evaluation. The DOE Richland Operations Office (RL) Environmental Restoration Program signed an Agreement in Principle with the regulators at the beginning of FY 1997, to conduct the evaluation for the disposition alternatives for the canyon facilities. In 1996, a Canyon Task Team of personnel from RL, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology (known as the Tri-Parties) conducted a series of workshops to identify an approach for the long-term disposition of the five main processing facilities in the 200 Area (B, T, and U facilities, the Plutonium Uranium Extraction Facility and the Reduction Oxidation Plant) at the Hanford Site. The assessment made by the Canyon Task Team centered on the possibilities of removing the processing facilities, leaving all or part of the facilities in place and identifying alternative beneficial uses for the facilities. The team concluded that the technical approach for dispositioning any of the facilities could be bounded by the following seven alternatives:

Alternative 0:
No Action

Alternative 1:
Full Removal and Disposal

Alternative 2:
Decontaminate and Leave in Place

Alternative 3:
Entombment with Internal Waste Disposal

Alternative 4:
Entombment with Internal/External Waste Disposal

Alternative 5:
Close in-Place—Standing Structure

Alternative 6:
Close in-Place—Collapsed Structure

The Record of Decision for the 221-U Facility will generate regulatory and technical precedence for future disposition of the other four remaining processing facilities at Hanford and other such facilities across the DOE complex.

Status and Accomplishments: Approximately $200, 000 in funding from FY2000 has carried over into FY2001 for Phase III feasibility study and proposed plan for a record of decision. The CDI has recently been awarded $700K additional funding through Pollution Prevention (P2).

Current Reporting Period Activities: The concrete coring unit, which consists of a Brokk 150N with concrete coring attachment, completed acceptance testing and has been used for obtaining concrete samples in the railroad tunnel and from process cells 5, 6, 26, and 36 to support the structural assessments and to determine whether or not potential contaminants have migrated beyond the confines of the cells. Samples have been sent to laboratories for analysis and the radiological results have been received. Chemical analysis results have not yet been received but are scheduled for completion in January 2001. The process cell access work is now complete. All previously unopened cells have now been opened, videotaped, and radiological surveys completed.

The 24-inch drain line characterization effort was completed during a previous reporting period and was a complete success, with all 800 feet of the drainpipe inspected and videotaped. A remote crawler and support equipment were procured, configured, and tested to support the deployment. An article on the deployment of the drain characterization robot was published in the November 2000 issue of Mechanical Engineering magazine. All radiological and some chemical analysis results have been received.

Plans for sampling Tank 5-5 are underway with the package preparation started and the sampling tools being ordered. Sampling is being scheduled for mid-January 2001.

The Wet Sample Analysis work package is complete and the sample tools are being built. Sample collection is scheduled for January 2001.

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Highly Selective Nuclide Removal System – Accelerated Site Technology Deployment

Objective and Scope: In 1992, the last of the five U.S. Department of Energy production reactors at SRS was placed into shutdown mode, with no intention to restart. With this action, the site entered an extensive deactivation and long-term surveillance and maintenance life-cycle phase. The integrity of the aging facilities has become a concern in recent years. Large volumes of contaminated water exist at some of these facilities at SRS (for example, fuel storage and disassembly basins). Treatment of this water requires removal of the water from the basin and shipment to the F and H Area Effluent Treatment Facility (ETF). A technology that is cost-effective and safe is needed to process the basin waters on location and selectively remove radioactive materials without transporting the water to ETF. The technology must reduce targeted nuclides to near DOE release limits and condition the water for direct release. Efforts to address these concerns have been initiated under the current funding for reactor monitoring and are being incorporated into the overall facility deactivation, decontamination, and decommissioning planning strategy. With the uncertainty of the basin integrity over time, a technology that can

remove radioactive contamination from the basin water while minimizing secondary waste generation is essential to the success of the deactivation of the DOE reactor basins. The SRS ASTD is deploying an innovative, highly effective water treatment system to remove selected radionuclides (both strontium and cesium) from millions of gallons of water. Overall, deactivation and decommissioning life-cycle costs are expected to be significantly lowered via deployment of the technology.

Status and Accomplishments: and **Current Reporting Period Activities:** As part of the EM-OST/NETL-sponsored ASTD project, 3M Corporation's water cleanup technology was deployed during the summer of 2000 at SRS's R-Reactor Disassembly Basin to cleanup some 5 million gallons of radionuclide contaminated water. The initial 8-week deployment of 3M's Selective Separation CartridgeTM technology at the Disassembly Basin wrapped up after treating nearly 1.1 million gallons of contaminated water. By the end of November, a total of about 3.6 million gallons of water had been treated. Water in the Disassembly Basin had an initial Cs-137 concentration of 92,000 pCi/L and it is now down to about 30,000 pCi/L. The Cs-137 is being removed with about 94 to 99.8 percent efficiency, with 3M's Selective Separation Cartridges removing Cs at the highest level. Operation of the technology will continue into 2001 in order to bring the cesium contaminant level down to release limits. Sr-90 removal, using the Selion/Graver technology, is scheduled to begin in mid-January 2001. This deployment shows the following benefits: (1) the efficient removal of Cesium-137 from the contaminated water, (2) operational costs of less than two cents per gallon of water treated, (3) estimated cost savings of $5 million at SRS over the site's baseline water treatment method, and (4) commensurate cost savings at numerous other sites around the complex for similar deployments of this 3M technology.

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Mobile Work Platform—Accelerated Site Technology Deployment

Objective and Scope: This ASTD project involves a partnership between the Fernald Environmental Management Project (FEMP) and Idaho National Environmental and Engineering Laboratory (INEEL) to purchase and deploy a Mobile Work Platform (MWP) at Fernald and the INEEL and potentially at other DOE Sites including Hanford, Rocky Flats and the Savannah River Site.

Five major complexes, Plants 7, 4, 1, Boiler, and 9, at the FEMP site have been successfully decontaminated and decommissioned during the course of ongoing environmental restoration activities pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Major complexes, Plant 2, Plant 8, and the Pilot Plant, will undergo D&D activities in FY2001 and FY2002. In addition to the FEMP facilities, the INEEL Test Area North–Building 616 has also been identified as a deployment location.

To address the sites' needs, Fernald and the INEEL will develop a common specification and then purchase a MWP that satisfies both sites' needs.

Status and Accomplishments: The performance specification for the MWP is complete and is available on the Fernald web page (*www.fernald.gov*) for use by any site that is pursuing the benefits that the MWP would provide. At this time however, based on a review of the mobile work platform specifications, the upcoming work on the D&D Projects, and current work practices by the D&D contractors, the purchase and deployment of the MWP is not the most efficient utilization of resources for Fernald.

Current Reporting Period Activities: A new TTP has been approved that will redirect efforts to a vehicle with remote characterization end-effectors. The vehicle is part of the Integrated Excavator Control System (IECS) and will address real needs at Fernald, and other sites that require the complex excavation of radionuclide contaminated soils during the below grade D&D of large structures. It will extend our successful efforts related to the in-situ characterization of soils. The proposed integrated system can be deployed in FY2001.

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Remote Size Reduction for Large Hot Cell Deactivation—Accelerated Site Technology Deployment

Objective and Scope: The 324 Building, located at the Hanford Site near Richland, Washington, is being deactivated to meet state and federal cleanup commitments. The 324 Building has several highly radioactive tanks, tank vaults, piping and large hot cells containing complex chemical processing equipment. To meet the cleanup commitments, there is a need to deploy more rapid and remote size-reduction, debris collection and removal, characterization and decontamination methods. Readily deployable deactivation methods that reduce worker exposure, secondary waste generation, costs, and risks are also needed. Deployment of a remote/robot work platform in the 324 B-Cell with full reach capabilities will significantly accelerate work tasks, eliminate the need for multiple, specialized tool design and procurement and reduce the overall program risks.

The Hanford Site ASTD project will fund the deployment of a robot work platform to support 324 B-Cell cleanup activities. Through this project, Hanford will procure and deploy a remote/robot work platform that is positioned with an overhead crane to perform deactivation activities. Following B-Cell cleanup, the work platform will be deployable for other 324 and Hanford site cleanup missions.

Status and Accomplishments: The contract with Cybernetix was modified to include fabrication of a special stand to allow the system to be placed in the airlock pipe trench for deactivation activities. These activities include cutting and plugging various size pipes, dismantling equipment, and removing sludge and other debris in the trench. Assembly, testing, and operator training for the system will be conducted at Hanford's 306E facility. DOE-RL and the State of Washington (Dept. of Ecology) are negotiating a change in Building 324 Deactivation milestones, which directly impact the deployment date of the work platform. At present, it is likely that system deployment will occur after July 31, 2001.

Factory inspection of the remote/robotic work platform and certification of the system is complete. Factory acceptance testing is scheduled for February 2001 with the unit arriving at Hanford in March 2001. Plans are to train operators for up to a month followed by "hot" deployment of the system in the 324 facility.

Current Reporting Period Activities: Nothing to Report

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Oversize Transuranic (TRU) Waste Laser Cutting System—Accelerated Site Technology Deployment

Objective and Scope:: DOE Nevada has a need to size-reduce and characterize 58 oversized TRU-contaminated metal boxes (total volume of 270 cubic meters) prior to shipping them to WIPP. The contents of these boxes are contaminated gloveboxes (32), a metal cutting lathe, lengths of metal piping, lengths of angle iron, and various scrap metals. The Hanford material requiring size reduction includes a minimum of 150 gloveboxes (there are also ductwork and piping). At Rocky Flats, the laser cutting system will also be applied to contaminated gloveboxes (150).

Status and Accomplishments: The installation of the laser, chiller, power supply, and cutting control station in the semi-trailer at the Physical Sciences Laboratory, New Mexico State University has been completed, verified, and accepted. The trailer and laser are now at GSI Lumonics in Minnesota to begin laser testing and check-out. The robotic arms (ABB Model 4400) to hold the cutting end-effector and the (ABB Model 6400) to hold the object being cut, are now expected to arrive at Lumonics around the February 2001 time frame. However, GSI-Lumonics in the meantime, will shortly be using a "loaner" robotic arm from ABB to begin integrating the laser cutting head positioning system with the robotics.

The Oversize Transuranic Waste Laser Cutting equipment from GSI Lumonics is used in ASTD to diminish the size of TRU waste to fit into WIPP containers.

Current Reporting Period Activities: GSI-Lumonics has initiated testing of the trailer-mounted laser cutting system at their Minnesota facilities.

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Personal Ice Cooling System (PICS) – Accelerated Site Technology Deployment

Objective and Scope: The objective of the Personal Ice Cooling System (PICS) (TECH ID 1898) is to control the heat stress of workers. This project is designed to deploy the PICS personal protective equipment to Fernald's workforce as well as to other DOE sites. Fernald will also implement administrative and educational programs designed to overcome cultural barriers and replace the existing baseline with the PICS. PICS is a self-contained core body temperature control system that uses ordinary ice as a coolant and circulates cool water through tubing that is incorporated into a durable and comfortable, full-body garment (pants, shirt, and hood). Water is frozen in bottles that are worn outside/inside of Anti-Cs in a sealed, insulated bag with a circulating pump attached to a support harness system. An adjustable-rate, battery-powered pump circulates the chilled water through the tubing in the suit. The adjustable pump allows the worker to control his temperature based upon his workload, unlike "ice vests" where the initial cooling is often extreme and uncomfortable. The ice bottle, pump, and suit make up only 12 pounds, a relatively small load. This effort provides the project team with nearly 100 PICS units as well as several central chillers and all required support equipment. The team will deploy various PICS systems (the three-piece [hood, shirt, and pants] suits and/or vests) to each of ten additional DOE sites

PICS is a self-contained core body temperature control system that uses ordinary ice as a coolant and circulates cool water through tubing that is incorporated into a durable and comfortable, full-body garment (pants, shirt, and hood).

by a team of Fernald labor-union personnel. This team will conduct proactive workshops on the PICS and its benefits to the workforces of at least ten other DOE sites (Nevada Test Site, Hanford, Oak Ridge, Paducah, Savannah River, Rocky Flats, Pantex, Los Alamos, Sandia, and Mound). It is envisioned that the educational workshops coupled with leaving "seed" PICS systems will create a demand for the PICS at the other DOE sites. This approach to widespread deployment using experienced workforce personnel is similar to the successful approach Fernald used to achieve widespread deployment of the oxy-gasoline torch. Not only will Fernald see the cost savings realized by using the PICS, but other DOE sites will as well. Deployment of the Oxy-Gasoline Torch was also added during FY2000.

Status and Accomplishments: This project is now complete. During the project, over 104 PICS cool suits were deployed to 17 DOE sites (Nevada Test Site, Hanford, Oak Ridge, Paducah, Savannah River Site, Sandia National Laboratory, Los Alamos National Laboratory, Pantex, Rocky Flats, Mound, Fernald, Lawrence Livermore National Laboratory, Carlsbad, Portsmouth, Ashtabula, West Valley and Argonne National Laboratory-East), and over 300 people trained to the technology. Additionally, the PICS (10 systems) have been deployed to the University of Findlay's Environmental Resource Training Center; 10 PICS systems deployed to the HAMMER Training Center, Richland, Washington; and 10 PICS systems deployed to the Washington, DC-based Center to Protect Worker Rights.

Also during the project, 18 Oxy-Gasoline torch systems were deployed to four training institutions (Hamilton County, Ohio vocational schools, Dayton Local 290 Iron Workers, Cincinnati Local 44 Iron Workers, and DOE's HAMMER training facility [16 systems], and one system to Portsmouth, Ohio, and one to West Valley DOE facility. Deploying the Oxy-Gasoline torch (a superior technology for cutting carbon steel, proven significantly safer, cheaper, and faster than the baseline oxy-acetylene torch) to training institutions will leverage DOE investment in, and speed the return on investment in the innovative technologies.

Current Reporting Period Activities: FEMP is assembling the final report.

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Integrated Decontamination & Decommissioning—Accelerated Site Technology Deployment

Objective and Scope: The overall objective of the Integrated Decontamination and Decommissioning (ID&D) ASTD project is to increase the use of innovative/improved but proven technologies on a large scale in the D&D of facilities in the DOE weapons complex. The reason for increasing the use of these innovative/improved technologies is that each has demonstrated improvements over current baseline methods in cost, schedule, waste generation, radiation exposure, or safety. Increased use on a large scale will be accomplished by doing actual D&D projects with the selected innovative/improved technologies, thereby increasing user familiarity and experience with them and adding them to the array of tools available for

D&D projects. The technologies added to the D&D toolbox have all been proven on a smaller scale, either through demonstration in the DDFA's LSDDPs or through commercial use, but they have not been used to decontaminate and decommission facilities across the DOE complex. After completing the ID&D ASTD project, the DOE expects to see increased use of these technologies that will result in ongoing cost savings at the INEEL, FEMP, Argonne National Laboratory-East (ANL-E), and other sites in the DOE complex. The ID&D ASTD project will provide for implementation and deployment of a suite of 12 D&D technologies. These technologies will be deployed at over 20 deployment sites (facilities) at the INEEL, FEMP, and ANL-E. The anticipated technologies included: oxy-gasoline torch;track-mounted shear; hand-held shear; GammaCam; BROKK 250 demolition robot; Decontamination, Decommissioning, and Remediation Optimal Planning System (DDROPS); soft-sided containers; snap-together scaffolding; concrete crusher; Personal Ice Cooling System (PICS); lead paint analyzer; and alloy analyzer.

Status and Accomplishments: This project is now complete. During the life of the project, 15 technologies were deployed. They are:

Brokk BM 250: A small, remote-controlled robot with a hydraulic boom extending 15 feet, to which multiple end effectors may be attached.

Oxy-gasoline torch: A faster, less-expensive tool for cutting carbon steel.

DDROPS: A pre-planning tool that helps project managers organize projects in such a way that waste packaging is optimized according to a variety of factors.

GammaCam™: A characterization device that imposes a visual display of radiation on a real-time black and white image of the area.

Personal Ice Cooling System (PICS): A suit with tubing through which ice-cold water is circulated by a battery-powered pump to keep workers cool when wearing Personal Protective Equipment.

Excel Modular Scaffolding: A versatile scaffolding that snaps together so workers do not need to tighten clamps by hand or spend time leveling scaffolding.

Soft-sided Waste Containers: A flexible low-level waste container that holds 3-4 times as much waste as a box and costs half as much; flexibility of the containers reduces landfill subsidence.

Lead Paint Analyzer: Handheld device for real-time detection of metals in paint.

Paint Scaler: A handheld, battery-operated drill with chisel attachments for rapid sample collection.

PCB Analyzer: A bench-top characterization instrument that detects several elements in samples, including chlorine, a possible indicator for PCBs

Surveillance and Measurement System (SAMS): A characterization device that provides isotopic information using a thallium-activated sodium iodide detector.

Global Positioning Radiometric Scanner System (GPRS): Detectors attached at a height of three feet to the front of a four-wheel drive vehicle to rapidly survey large areas for radioactive contamination.

En-Vac: A robotic abrasive grit blasting scabbling system that removes contamination from concrete or metal walls; attaches to the wall with high-vacuum suction.

Hand-held Shear: These technologies have resulted in a total of 66 deployments at various DOE sites. During the course of the project, these deployments saved about $800K; and over the next 10 years, savings of at least $25.6 million are expected.

Track Mounted Shear: Mobile demolition for large structures.

The ASTD ID&D project has been a huge success. The technology suite has replaced traditional baseline technologies at all three sites, resulting in cost and schedule improvements during D&D operations at several DOE facilities. Throughout the project, engineering and D&D Operations worked closely to integrate their efforts as a team, this was a key factor in the success of the project. They focused on selecting technologies that meet large needs and provided the most bang for the buck. In addition, they used innovative approaches when calculating cost benefit analyses to minimize data collection while maintaining accuracy. In doing so, they kept the project focused on deploying as many technologies as possible that are useful and provide large benefits.

Significant accomplishments of ID&D at FEMP include deploying three technologies (Hand-held Shear, Oxy-Gas Torch and Track Mounted Shear) and removal of nine structures. FEMP has reported cost savings of $200K to date. They estimate additional savings of $7.8M for 23 buildings. FEMP will continue deployments during D&D activities.

The technology used at ANL-E has accomplished removal of the CP-5 reactor bioshield. Two BROKK demolition units worked in tandem and accomplished the task with significantly reduced radiation dose to workers.

At the INEEL, 15 technologies have been deployed and are being used to provide assistance with D&D of 25 different facilities for a total of 66 deployments saving $797K. INEEL's cost savings are estimated at $25.6M over the next 10 years.

Other sites (Savannah River, Rocky Flats, Hanford, Pantex, Ashtabula, Mound and Oak Ridge) are considering use of all or some of the ASTD ID&D technologies.

Current Reporting Period Activities: The ID&D team is preparing the complete cost benefit analyses and the final cost and performance report for the project (expected in February 2001).

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▼Smart 3D Characterization of the Brookhaven Graphite Research Reactor (BGRR)

Objective and Scope: The BGRR was a graphite-moderated and -reflected, air-cooled, thermal neutron research reactor that operated from 1950 to 1968. In 1997, following safe shutdown during the 1970s and 1980s, a site-wide review found radioactive water in the BGRR underground air-cooling ducts. Subsequently, it was determined that a comprehensive investigation of the environmental vulnerabilities and overall facility condition should be conducted. The first phase of this investigation involves characterization to support D&D planning of the BGRR facility including; the reactor building (701), the reactor pile (702), the fan house (704), the instrument house (708) and the canal house and outdoor pad (709). Characterization will also be needed to support waste disposal operations during decommissioning operations and to verify regulatory compliance following D&D operations.

DDFA supports the BGRR Decommissioning Project characterization effort through an Accelerated Site Technology Deployment (ASTD) project funded in September 2000. This ASTD project, "Smart 3D Characterization," is also supported by the Subsurface Contaminants Focus Area and will deploy innovative characterization and sampling techniques coupled with 3D modeling capabilities to characterize soils and below-grade concrete ducts.

Current Reporting Period Activities: Efforts during the first quarter of FY2001 focused primarily on procuring technologies to support the below ground duct deep soils characterization efforts. Specific technologies that have been acquired include a portable (small footprint) geoprobe, capillary adsorbent tracer sampler (CATS), perfluorocarbon tracers (PFTs), and the environmental visualization software (EVS). Sampling ports have been installed using the small footprint geoprobe in preparation for PFT sampling activities. The EVS software and 3D imaging system has been installed. Characterization data from the Transfer Canal has been incorporated into the EVS and will be used to conduct training on file and data manipulation.

Other efforts during the reporting period included continued deployment of the InSitu Object Counting System (ISOCS) and the BetaScint at the BGRR site. These two technologies were initially deployed during the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) ASTD project completed in FY2000. This previous project showed the clear benefits of the ISOCS and BetaScint technologies for characterization of the reactor pile and above grade ducts. Recent activities focused on characterization of soils beneath the Canal House.

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Rocky Flats D&D Initiative and Associated ASTD Projects

Objective and Scope: Rocky Flats is on an agressive, accelerated schedule to achieve cleanup and "closure" of the Site by the end of 2006. The baseline Plan for the Rocky Flats Closure Project involves dispositioning over 900 contaminated gloveboxes, more than 450 production process tanks, thousands of feet of ventilation system piping, and miles of production process piping. In order to accomplish this challenging goal, Rocky Flats must apply new and improved technologies and methods in the areas of characterization, decontamination, size reduction, and waste handling and packaging. In fact, continued application of new and innovative technologies is a key assumption written into the baseline Plan to close Rocky Flats successfully. DDFA is supporting this aggressive schedule through the deployment of proven, commercially available technologies and innovative systems that require only minimal modifications to be used at the site.

A significant cost in the D&D of buildings at RFETS is the size reduction and packaging of plutonium-contaminated gloveboxes, tanks, and other equipment. DDFA is supporting the disposition of these systems through the Rocky Flats D&D Initiative (RFI), as well as Accelerated Site Technology Deployment (ASTD) projects including:

- Enhanced In Situ Decontamination and Size Reduction
- Remote Operated Size Reduction System
- Remote In Situ Size Reduction of Plutonium Gloveboxes
- Decontamination of Gloveboxes and Equipment without Size Reduction
- Upgrade Radiation Instruments
- Interbuilding Transfer of Plutonium Gloveboxes

All of these projects seek to identify and deploy proven, commercially available technologies and innovative systems that require only minimal modifications for the safe and cost-effective disposition of contaminated processing equipment and systems.

Status and Accomplishments: A significant cost in the D&D of buildings at RFETS is the size reduction and packaging of plutonium-contaminated gloveboxes, tanks, and other equipment. DDFA is supporting the disposition of these systems through the Rocky Flats D&D Initiative (RFI), as well as Accelerated Site Technology Deployment (ASTD) projects including:

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- Remote In-situ Size Reduction of Plutonium Gloveboxes

- Decontamination of Gloveboxes and Equipment without Size Reduction
- Upgrade Radiation Instruments
- Interbuilding Transfer of Plutonium Gloveboxes

All of these projects seek to identify and deploy proven, commercially available technologies and innovative systems that require only minimal modifications for the safe and cost-effective disposition of contaminated processing equipment and systems.

Current Reporting Period Activities:

Enhanced In Situ Decontamination and Size Reduction—Rocky Flats is currently preparing for an audit by the Waste Isolation Pilot Plant (WIPP) in mid to late January 2001. WIPP will be auditing the entire process involved with the disposition of TRU waste and its shipment offsite. As part of this audit, the Standard Waste Box (SWB) Counter, developed at LANL, will start assaying waste and gathering data points for WIPP certification of the system. It is not expected that enough data points will be generated before completing the audit for WIPP to certify the SWB Counter. Therefore, WIPP officials have agreed to return at a later date to finish the SWB Counter certification audit. After notification of "passing" the WIPP audit, Rocky Flats will deploy the system beginning in the late second quarter or early third quarter of FY2001.

Major modifications to the S. A. Robotics (Loveland, Colorado) Inner Tent Chamber Phase I version 2 in Building 771 have been completed as has the readiness assessment. Implementation for size reduction of "hot" equipment is expected in early January 2001. The modifications to the ITC include an additional manual cutting plasma arc tool and sealed-in operating area. The estimated throughput of the system is one glovebox per shift. The Phase II version 1 ITC,which includes remote size reduction capabilities while maintaining the option of using manual size reduction methods, has been delivered and installed. Readiness review and demonstration are expected by the end of March 2001.

Remote Operated Size Reduction System —On November 15, 2000 the Remote Operated Size Reduction System (ROSRS) underwent factory acceptance testing at the PaR Systems facility in Shoreview, Minnesota. The purpose of this test was to show that the integrated ROSRS was capable of meeting user requirements and to identify where further improvements were necessary. The system has extensive computer coding for early warning of system failures and faults and for conducting some semi-autonomous routines, such as tool change out. The demonstration included all aspects of the integrated system. A glovebox was moved in automatically from the prep area, size reduced and then disposed. The system worked well and as the operators become more familiar with the system, it is expected that there will be a corresponding increase in operator efficiency and material throughput. Rocky Flats is currently considering installing ROSRS in Building 707.

Remote In Situ Size Reduction of Plutonium Gloveboxes—Kaiser-Hill has narrowed the field down to two companies that have submitted proposals for the design, fabrication, and installation of a Remote In Situ Size Reduction System (ISSRS). Since they are both small companies, a "financial analysis" of the companies is being conducted to ensure that they have the fiscal resources to meet the contract. The ISSRS will be used to size-reduce and package large oversized gloveboxes and other contaminated equipment in Building 771 that cannot be transferred to ROSRS. Additional technologies are being investigated for in situ size reduction applications at other Rocky facilities. The Nukem Remotely Operated Advanced Segmentation Process (RASP) is being considered for size reduction of a five-axis mill in Building 776 and an exothermic cutting system (Magmafusion) is being considered for in situ applications in Building 707.

Decontamination of Gloveboxes and Equipment without Size Reduction—This project supports the deployment of a suite of decontamination technologies to allow shipment and disposal of plutonium-contaminated gloveboxes, tanks, and other equipment while obviating size reduction requirements. By reducing surface contamination, this equipment can be disposed of as LLW, thus minimizing the total waste volume of material to be shipped to WIPP. Several different approaches are being investigated, including

two innovative solutions that are partially funded through AEA Technologies' International Agreement with OST. It is expected that one or more contracts will be awarded in early FY2001.

Upgrade Radiation Instruments—This project supports the deployment of a suite of state-of-the-art instrumentation and data collection systems required for compliance with radiation control, release limits, and control/tracking of waste. Deployments occurred in late FY2000 of the wide-energy neutron detectors in Buildings 371, 771, 776, and 707. The system integration of data for residue processing was also deployed in late FY2000 for ash and wet residues in Building 371. Systems for Building 371 fluoride residues and Building 771 D&D waste are planned for deployment in FY2001. Final decisions on additional instrumentation under this project are currently being evaluated.

Interbuilding Transfer of Plutonium Gloveboxes—This project was first funded in December 2000. At this time there are no current activities to report. The purpose of this project is to design, fabricate, and install a remote system for on-site transfer of contaminated gloveboxes and other processing equipment to ROSRS for size reduction and packaging. Final decisions on the Interbuilding Transfer System are contingent on final decisions by Kaiser-Hill regarding installation of ROSRS.

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▼Diamond Wire Saw Demolition and Size Reduction of a Reactor Bioshield – Accelerated Site Technology Deployment

Objective and Scope: The Columbus Environmental Management Project was awarded an ASTD project to deploy a diamond wire saw system to size reduce an activated bioshield and associated structures in a decommissioned research reactor at Battelle's West Jefferson site in Columbus, Ohio. The bioshield is made of high-density concrete approximately eight feet thick with an extensive internal latticework of carbon-steel reinforcement bars. This technology was used successfully in decommissioning projects at Fort St. Vrain and Shoreham Nuclear Power Plants, but has seen little application within DOE's decommissioning projects. The estimated cost to size reduce the Building JN-3 bioshield at West Jefferson is $780,000 using the diamond wire saw compared to an estimated cost to dismantle the bioshield with the baseline technology of heavy jackhammers at $1,051,000. Thus, size reduction using the diamond wire saw represents a cost saving of about 25 percent compared to the baseline approach. Subsequent deployments of the diamond wire saw are planned for Mound and West Valley.

Diamond Wire Cutter

Status and Accomplishments: Dismantle of the bioshield is projected to be completed in February 2001.

Current Reporting Period Activities: No significant activities to report this quarter.

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Reducing, Reusing, and Recycling Concrete and Segmenting Plate Steel and Tanks Utilizing a Universal Demolition Processor – Accelerated Site Technology Deployment

Objective and Scope: As decontamination and decommissioning work at Fernald progresses from above-grade facilities to at-grade and below-grade facilities, there will be a bona fide need for new technologies to process concrete. Fernald can realize significant cost savings by reprocessing and reusing a portion of the site's concrete. There is a defined need for aggregate to build and strengthen the site's transportation infrastructure in and around the On-Site Disposal Facility (OSDF). Project personnel in the Soils and Water Division have an estimated need for up to 15,000 cubic yards of aggregate per year, for the next six years. Not recycling the site's concrete means that tons of aggregate will have to be trucked in from offsite and subsequently disposed in the OSDF. Reprocessing a portion of the concrete saves the costs associated with the purchase of virgin aggregate and its subsequent disposal cost. The site can also realize increases in safety, efficiency, and schedule by using the plate shear capability of the universal processor. Fernald has numerous large, heavy steel tanks including two water towers and numerous tanks made of stainless steel.

To address the site's needs, EM's Office of Science and Technology (OST) has partnered with FEMP in an ASTD project with OST providing $800,000 for this deployment. Through the activities in this project, innovative technologies will be deployed to accelerate demolition/recycling of construction materials for road construction, and for segmenting large, hard to cut, plate steel and tanks. Overall, decommissioning life-cycle costs are expected to be significantly lowered via the deployment of these technologies.

The concrete crusher being loaded with concrete debris.

Status and Accomplishments: No updates to report. The system is still in the procurement process.

Current Reporting Period Activities: No activity to report.

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Improved Measurement and Monitoring Systems – Accelerated Site Technology Deployment

Objective and Scope: The Fernald Environmental Management Project (FEMP) is a 1,050-acre DOE Closure Site currently undergoing decommissioning and environmental restoration. As environmental cleanup work at the FEMP accelerates towards closure and long-term stewardship, there is an increasing need for new, innovative technologies to perform real-time physiological monitoring, land surveying, and wireless radon monitoring. In the process of deactivating and decommissioning DOE facilities, individual laborers sometimes

need to work in/near radiological and hazardous locations, and in situations that lead to extreme physical conditions. At FEMP, these types of extreme conditions will likely occur in the upcoming FEMP Silos project and in other restoration projects across the site. Technologies are needed that reduce workers' risk during engineering, construction, and environmental restoration operations. To minimize these risks, three new technologies have been identified for deployment at FEMP. Collectively, these technologies will provide for the monitoring of worker vital signs, improved land surveying, and the remote transmission of radon monitoring data.

Status and Accomplishments: The Real-Time Physiological Monitoring System (RTPMS) and the Remote Prismless Total Station (RPTS) equipment were received and will be demonstrated in February 2001. A minimum of ten wireless radon monitors will be purchased under a contract awarded in the current period. All three are planned for deployment in Spring 2001.

Current Reporting Period Activities: No activity to report.

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Intrusive and Non-Intrusive Characterization through Concrete Walls and Floors—Accelerated Site Technology Deployment

Objective and Scope: In mid-FY2000, the Miamisburg Environmental Management Project was awarded an ASTD project to ascertain the nature and extent of contamination in an area under SW Building known as the "Old Cave." The Old Cave is actually the entombed remains of a 1950's hot cell, which must be removed before the City of Miamisburg, Ohio, will accept ownership of the Mound site. In SW Building, the Old Cave is located under an area designated SW-19. Because of lack of knowledge of what is in the Old Cave area, ultra conservative estimates of the amounts of Ac-227 and Ra-226 have been made which required the Old Cave to be classified as a Category 2 Nuclear Facility. It is considered highly unlikely that that much radioactive material resides in the Old Cave. The approach is to characterize SW-19, the surroundings, and the entombment. In Phase I—Non-Invasive Investigations, they plan to characterize the entombment using ground penetrating radar and time-domain electromagnetics, gamma spectrometry, drain exploration, and radon monitoring. In Phase II—Invasive Investigations, they plan to perform these investigations with respect to the entombment via diamond core drilling and/or Geoprobe with a real-time position location determination device. Once better defined radioactivity levels are determined, and a final design decision to the Baseline Plan is made, several enhancements that shorten the schedule and reduce costs may result. A baseline recovery of only one week would recoup the entire ASTD investment. If the baseline acceleration is greater than the one week, the return on investment will increase proportionally as additional weeks/months are saved from the baseline. Based on the Value Engineering study, it is conservatively estimated that four months can easily be recovered when compared to the present technical approach.

Status and Accomplishments: The Phase I – Non-Intrusive Characterization Process Summary Report was completed in November. During Phase I, non-invasive measurements were obtained using the following technologies: 1) ground-penetrating radar, 2) electromagnetic ground conductivity, 3) gradient magnetics, and 4) gamma spectroscopy. This characterization was to locate objects or structures buried within the entombment and to define the nature and extent of contamination. The best geophysical information was gathered from the topside of the entombment by electromagnetic surveying. Gamma spectroscopy measurements demon-

strated evidence of both Ac-227 and Ra-226 contamination in many areas. Thorium-232 and cesium-137 were also indicated. In addition, uranium-238 and cobalt-60 were identified on the surface in a few specific areas. These measurements indicate that radioactive soil contamination is present beneath the floors in the rooms adjacent to the entombment. Contamination appears to be present within the walls around the entombment, as measured from adjacent rooms. Measurements from directly above the old process area indicate that contamination has migrated into the concrete cap. The gamma spectroscopy survey successfully identified and mapped the locations of subsurface radionuclides in the area, but was unable to quantify activity levels

Current Reporting Period Activities: The Phase I—Non-Intrusive Characterization portion of the project was completed in November 2000. The current path forward involves conducting a feasibility study to determine if grouting the entombment area is possible, and whether doing so can be accomplished safely. The intent of the grouting is to enhance the design and add safety to the project. The Old Cave team is currently determining the path forward for Phase II.

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MARSSIM Innovative Characterization at Nevada—Accelerated Site Technology Deployment

Objective and Scope: While portions of the MARSSIM methodology have been used at the Nevada Test Site (NTS) and other EM sites, typically, the methodology has been used to characterize and/or release 2-D surfaces (interior of buildings) and surface soil. There has been no systematic application of MARSSIM for subsurface soil investigation characterization or exterior building and roof verification surveys. The NTS deployment of MARSSIM will concentrate on non-standard applications where there are potential cost savings when compared to the NTS baseline methodologies.

In addition to the MARSSIM surveys, there is an immediate need to develop more cost-effective waste characterization methodologies. The baseline NTS waste characterization methodology requires a minimum of five samples to be collected from each B-25 box.

This ASTD project will apply MARSSIM for non-standard applications including implementation (and development) of a 3-D statistical approach for characterizing subsurface soil. The results of this effort will be to reduce the number of sampling locations and/or an increase in the confidence of the subsurface characterization data. The MARSSIM methodology will also be deployed for building roof top and building exterior release surveys, to reduce the necessity of using the baseline instrument surveys that are now required for the site release of each individual waste load.

In addition to deploying the potentially cost reducing MARSSIM methodology, Brookhaven National Laboratory will provide technical assistance for the deployment of the In Situ Object Counting System (ISOCS) deployment. The ISOCS deployment will focus primarily on waste characterization, but will also be deployed as an integrated technology as part of the MARSSIM roof top survey. By deploying ISOCS and applying isotope scaling factors developed from characterization sample results, real-time waste characterization of B-25 boxes and 55-gallon drums can be accomplished.

Other technologies such as the Gamma Detector Instrumented Cone Penetrometer (CPT) will also be deployed as part of the MARSSIM survey and modeling effort for subsurface soils.

Current Reporting Period Activities: This project was first funded in December 2000. Efforts have been initiated to develop the MARSSIM survey design, which is

expected to be completed in April 2001. Field implementation of the MARSSIM survey and deployment of the innovative technologies are expected to be completed by September 2001.

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Contaminated Large Equipment—Accelerated Site Technology Deployment

Objective and Scope: The Savannah River Site has identified over 600,000 cubic feet of radiologically contaminated large equipment (CLE) requiring disposition. This is representative of a much larger quantity than anticipated as the site proceeds into more D&D. DOE Order 435.1 will elevate regulatory attention and surveillance impacts for this stored material with significant cost increase for deferring permanent disposition. Disposal of this material "as is" would consume the SRS waste disposal capacity, be cost prohibitive, and waste DOE assets.

SRS proposes to obtain the following equipment to augment existing infrastructure and to facilitate the size reduction and decontamination of CLE:

- Large-span Permacon Hut for containment
- Robotic/remote operated shears
- Robotic/remote operated plasma arc cutting system
- Robotic decontamination system

The above-proposed approach capitalizes on the remote-operation technologies and equipment to minimize health and environmental risks as well as accelerating cleanup at a reduced cost while meeting project objectives. This equipment will be used in conjunction with the SRS Decontamination Center to provide capabilities for disposition of large equipment and to support on going routine decontamination work.

Status and Accomplishments and **Current Reporting Period Activities:** This project was first funded in December 2000.

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Deployment of Improved Technologies for Cleanout of the F-Reactor Fuel Storage Basin—Accelerated Site Technology Deployment

Objective and Scope: Cleanout of the F-Reactor Fuel Storage Basin (FSB) is an important step in completing the Paths to Closure for the Hanford Site. The F-Reactor FSB has some complex technical issues and unique challenges, including identification, removal, and disposal of miscellaneous irradiated/contaminated debris that is potentially interspersed with pieces of spent fuel elements buried under 6.1 m (20 ft) of sandy soil. Broadly, the technical needs associated with the project include 1) characterization, 2) backfill removal and segregation, and 3) material removal and segregation.

History and preliminary characterization information indicate that the top 5.2 m (17 ft.) of fill should be free of radiological or chemical contamination, and that most of the debris is expected to be found primarily in the bottom 15% of the basin.

Status and Accomplishments and **Current Reporting Period Activities:** The regulatory documentation, conceptual engineering, and planning for F Reactor FSB D&D were initiated in October 1999. Characterization planning, regulatory approvals, and definitive engineering were completed in FY2000. Preparation of equipment specifications and purchasing was initiated in FY2000 allowing for technology deployments in the second quarter of FY2001. The F-Reactor FSB D&D work activities should be complete at the end of FY2001.

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Deactivation & Decommissioning (D&D) Consortium

Objective and Scope: In December 1997, DOE signed a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI) and several nuclear utilities to jointly develop and deploy new D&D technologies. DOE's objective is to expand the reach of benefits of the "leading-edge" technologies being deployed within the DOE nuclear complex. The MOU Consortium established a charter in early 1998 and identified challenging technological areas common to both DOE and the commercial industry. Both DOE and commercial sites will be used for these demonstrations and deployments.

DOE and EPRI are collaborating to conduct quarterly workshops at various nuclear plants around the country, each focusing on a particular decommissioning area. DOE and the utilities present the most recent, innovative technologies to improve productivity and worker safety while reducing cost. The workshops will solicit feedback from hands-on plant managers and field workers. Topics covered to date address low-level waste disposal, concrete decontamination, imbedded pipe decontamination, and site characterization.

Status and Accomplishments: The first technology demonstration resulting from the DOE/EPRI/Utility Consortium was completed at the Rancho Seco Nuclear Power Plant.

The first technology demonstration involved the concrete shaving technology developed by Marcrist Industries, Ltd. Two separate pieces of equipment were demonstrated. Both used a diamond-impregnated shaving drum as the cutting tool for removal of the concrete surface. Generated dust was collected by a vacuum system and deposited in a waste drum.

The first piece of equipment was a self-propelled, electric powered floor shaver. It was demonstrated on clean and radioactively contaminated floor areas in the reactor turbine building. Several parameters were recorded as part of the demonstration and the technology was well accepted by the operating staff.

The second piece was a hydraulically powered wall-shaving unit. For purposes of the demonstration, the unit was mounted on a forklift.

Current Reporting Period Activities: Members of the DDFA team met with the Decommissioning Manager at Rancho Seco in October 2000 and discussed future plans for the NETL support of the MOU and the Sacramento Municipal Utility District (SMUD) level of interest in future demonstrations of innovative technologies at Rancho Seco.

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Florida International University

Objective and Scope: The Hemispheric Center for Environmental Technology (HCET) at Florida International University, is working on several D&D related research projects under a grant awarded by the DOE Office of Science and Technology. These FY 2001 projects include:

- Deactivation and Decommissioning Technology Assessment Program
- Technology Information Management and Dissemination
- Technology Development, Integration, and Deployment Program

- Worker Health and Safety Research and Technology Development
- D&D Waste Disposition and Treatment
- Long-term Monitoring and Stewardship for DDFA

Status and Accomplishments: Under this project and earlier technology assessment projects funded from other sources, FIU-HCET has assessed over 80 baseline and innovative technologies for deactivation and decommissioning (D&D) application under standardized, non-nuclear testing conditions. Many of the technologies identified for demonstration at FIU-HCET are selected to address the needs identified in the EM-50 Needs Management System (*http:// EM-Needs.em.doe.gov/ Home/*). As a result of these assessments, directly comparable performance data related to operations and maintenance, primary and secondary waste generation, and health and safety have been compiled. These data have been valuable in assessing whether a technology meets the screening criteria for those DDFA LSDDPs where these technologies are being considered, as well as assisting EM-30 project managers in making decisions on the deployment of innovative technologies.

Current Reporting Period Activities: Evaluations of the three Particulate Matter Continuous Emission Monitoring Systems (PMCEMS) at the TSCA Incinerator in Oak Ridge, Tennessee, were completed in October. The three systems performed without malfunctions. Data collected from the test was submitted to FIU-HCET. A technology summary report will be completed by February 2001.

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AEA Technology DDFA Projects

Through an International Agreement, the DDFA has engaged AEA Technology to use their knowledge and expertise to address specific deactivation and decommissioning problems throughout the DOE weapons complex. Currently, DDFA is finalizing new scope with AEA for the following projects:

Accessing & Sampling the Retention Basin at the INEEL Test Reactor Area (TRA)

The retention basin at the TRA facility in INEEL is a below-grade concrete settling tank some 128 feet long, 40 feet wide and 15 feet deep. Originally built in 1961, the facility was used to settle the heavier wastes that were generated in the facility allowing the lighter liquid to flow through to the evaporation pond. In 1972, it was established that the basin was leaking and that the inflow of liquid into the retention basin was less than the leakage out of the basin. The basin was then removed from service.

It is estimated that between one to three feet of sludge remain unevenly distributed across the base of the tank. Under the voluntary consent order, signed between INEEL and the State of Idaho, the retention basin is due to be emptied and closed. As the first step in the eventual removal of the tank from the ground, AEA will work with site engineers to establish the best methods of gaining entry to the basin for sampling, inspection, and retrieval of the sludge. The outcome of this initial investigation will be the development of a test plan for optimal decommissioning, including demonstration of an improved sampling and retrieval system in FY2002.

Demonstration of an Artisan™ Manipulator for Debris Retrieval from a Hot Cell Facility at the Columbus Environmental Management Project (CEMP)

The CEMP is currently decontaminating affected buildings and grounds in order to return these facilities to the owner in a condition suitable for use without radiological restrictions. A major challenge currently facing the site is the size reduction, decontamination, and removal of debris from hot cells. The cells contain a variety of materials including tables, steel plates, tools, and lighting fixtures. The Master Slave Manipulators (MSMs) currently in the cells are not

capable of performing the required tasks of size reduction and waste packaging. The facility managers have expressed a need for a robust manipulator capable of performing the tasks required.

AEA Technology will provide a hydraulic manipulator mounted on a mobile platform that will be capable of performing the tasks identified by CEMP representatives in each of the cells. The manipulator, an ARTISAN™, has been deployed throughout Europe to perform tasks similar to those described. AEA Technology will also provide training for CEMP operators as well as the necessary documentation required for operations and maintenance of the ARTISAN™ arm. The existing manipulators have a very limited load capacity (25 lb.), cannot reach the cell corners, and cannot withstand significant vibration. Therefore, to perform gross decontamination and cleaning, alternative remote technologies such as the ARTISAN™ Manipulator Arm (with a 1000 lbs. load capacity and extended reach) must be used for these activities. This deployment will save significant time, labor, and potential worker dose compared to using conventional manipulators with the existing crane in a more hands-on operation.

Removal of Waste from the WD Complex at Mound

Building WD is a multi-story facility used for the treatment of low specific activity (LSA) radioactive wastes generated by process activities at Mound. The contaminated facility is 28,800 square feet and has exterior walls of reinforced concrete and concrete block. The roof is concrete slab. As the first step in the D&D of the facility, 33 waste tanks and other miscellaneous vessels must be emptied and removed. AEA Technology will assist Mound in determining the optimal approach for gaining entry into the tanks to allow sampling, inspection, and retrieval, as well as establish a strategy for the ultimate decommissioning of the tanks/vessels at the WD facility.

Options Study to Decontaminate Exhaust Ducting in Buildings 324 and 327 at Hanford

DOE has accelerated the Decommissioning and Dismantlement Schedule of the facilities in the 300 Area at the Hanford Reservation site in Richland, Washington. As part of the overall decommissioning plan at the Hanford site, it is planned to deactivate Building 324. One of the major projects involved in deactivating this building is the decontamination of the exhaust ductwork from the Radiochemical Engineering Cells (REC). To achieve this task, project managers will evaluate the most effective technologies and processes in terms of worker safety, cost effectiveness, track record, and schedule acceleration.

AEA will assist the Building 324 project representatives in developing an Options Study to characterize and decontaminate the ductwork in the facility with particular interest on the B Cell exhaust duct. The Options Study will identify suitable alternatives to achieve the project goals, which could be demonstrated as part of future scopes of work to determine the most beneficial program for DOE. AEA Technology representatives will review technologies and processes that have been deployed in other nuclear facilities in Europe and the United States for characterizing and decontaminated ductwork.

AEA Technologies has presented the Options Study to the Hanford contractor and DOE personnel for comment and sanction. AEA Technology is currently finalizing work scope for the demonstration of a preferred technology and methodology to be conducted in FY2002. This activity is part of a "package" of FY2001 tasks that focus on Hanford challenges. Details of AEA's D&D tasks will be provided in a future report.

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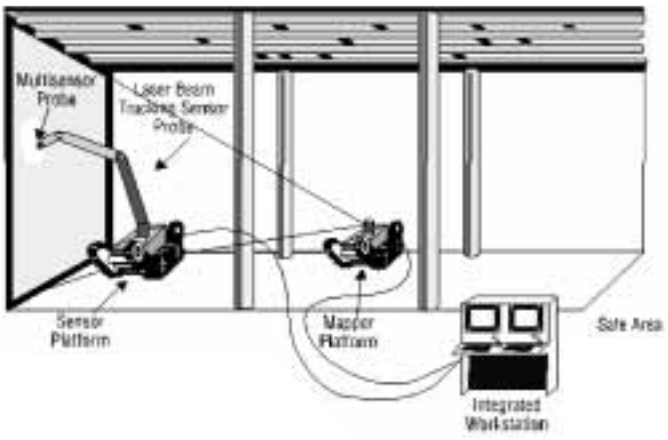
2.2 Facility Characterization

Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS)

Objective and Scope: Coleman Research Corporation (Coleman) will develop a remote system that can rapidly analyze in situ hazardous organic and radionuclide contaminants on structural materials. This remote system is the Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS). The 3D-ICAS consists of a mobile sensor platform and a mobile mapper platform that operate in contaminated areas, and an integrated workstation that remains in a safe location. Development of this technology will occur in three phases.

Status and Accomplishments: The 3D-ICAS was successfully integrated with mobile platforms at Oak Ridge National Laboratory. The Coherent Laser Radar Mapper was operated on the OmniMate robotic platform and the contaminant analysis units and robot arm carrying the multisensor probe head were integrated on the overhead transporter. The system was subsequently demonstrated at Oak Ridge National Laboratory (ORNL), Robotics, and Process Systems Division in October 1998. The demonstration was conducted in the hi-bay area using a wall unit specially constructed for the demonstration. The wall unit consisted of pieces of cement-based wallboard and a small piece of an asbestos-containing material. The wall unit was purposely contaminated with low-levels of organic materials, alpha emitters, and a beta emitter. The demonstration consisted of mapping the wall unit, displaying the map, selecting points to be surveyed, running the contaminant survey which required moving the sensor/analysis unit with the transporter and acquiring the sensor unit with the 3D mapper, displaying the measured contamination in real time, and displaying detailed spatial and contamination data after the survey was completed. An unfortunate hardware failure the morning of the day before the demonstration prohibited acquisition of contaminant data from the high-speed gas chromatography/mass spectrometry (HSGC/MS) and only the Molecular Vibrational Spectrometer (MVS) provided real-time identification of the substrate material during the demonstration. This was a significant success since the MVS correctly identified the wallboard as being cement although the particular substrate sample had not been included in the system's neural network training set. Failure of the HSGC/MS was unfortunate, but its performance had been well documented and demonstrated prior to the demonstration at ORNL and it did not detract from the main objective of the demonstration, which was to show end-to-end system operation with the 3D-ICAS mounted on ORNL mobile platforms. The GC/MS was shipped back to Thermedics and they are in the process of replacing the parts and recalibrating the system.

Current Reporting Period Activities: The contractor has been completing preparations for the final integrated testing of the 3D-ICAS which will be performed at their facility in Boston. After completion of the testing, the system will be tested at the Florida International University at their mockup facility. The tests are expected to be performed in February 2001.



Three-Dimensional Integrated Characterization and Archiving System (3-D ICAS) is a remote mapper and sensor platform to use in contaminated areas.

For more information:

Tech ID 97

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Fast Response Isotopic Alpha Continuous Emissions Monitor

Objective and Scope: The objective of this effort is to develop and test Continuous Air and Emission Monitoring (CAEM) instrumentation for alpha-emitting radionuclides. This instrument will be designed in order to certify the proper performance of airborne emissions from ambient air and in equipment emissions encountered during D&D of DOE's surplus facilities. The proposed system will also meet the DOE's alpha CAEM requirements through the development of an innovative, high-resolution, online air/gas alpha monitor. The instruments will be capable of operating either as a stack emissions monitor, a process control instrument, or for the control of off-gas from decontamination, dismantlement, and air handling equipment.

Initial efforts will be focused on the development and evaluation of a rapid alpha-counting-based instrument to monitor ambient air and emissions to meet the monitoring and equipment control needs of surplus facilities undergoing decontamination and decommissioning. This development will establish the feasibility of a prototype instrument for use in detecting radionuclides that are present, or create susceptibility to exposure, throughout the DOE complex. The prototype instrument will be tested under the supervision of DOE's Inhalation Toxicology Research Institute in Albuquerque, New Mexico. Based on the prototype results, efforts may be continued to full-scale commercial prototype and demonstration in one of DDFA's LSDDPs.

Informal meetings were held with various DOE CAEM end users. For example, the personnel associated with LANL's upgrade of their continuous air monitoring system for the Plutonium Facility at Technical Area 55 (TA-55) continue to be very interested in the further development of the Fast-Response CAEM. LANL was interested in hosting the Phase II field test in their back yard, at the LANL TA-54 LSDDP.

Status and Accomplishments: This project is in the base phase of a two-phase developmental effort. This phase involves the design, development, and preliminary testing of a laboratory-scale instrument. Testing will initially be conducted using naturally occurring radon progeny in ambient air. If the Optional Phase II is exercised, the Phase I instrument will be critically evaluated at the Lovelace Respiratory Research Institute (LRRI) with characterized plutonium aerosols; then an improved instrument will be built and field-tested at a suitable DOE site.

Informal meetings were held with various DOE CAEM end users. For example, the personnel associated with LANL's upgrade of their continuous air monitoring system for the Plutonium Facility at Technical Area 55 (TA-55) continue to be very interested in the further development of the Fast-Response CAEM. LANL was interested in hosting the Phase II field test in their back yard, at the LANL TA-54 LSDDP.

Current Reporting Period Activities: The contractor continued development of the advanced prototype. This prototype should be ready for testing in early February 2001.

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Technology for Real-Time Measurement of Surface and Airborne Beryllium

Objective and Scope: The objective of this contract is to develop, test, and demonstrate an innovative, real-time monitor for surface and airborne beryllium. This field-portable device is based on Laser-Induced Breakdown Spectroscopy (LIBS) and will be applicable to continuous air monitoring; field analysis of filters from personal air monitors, and analysis of surface wipe samples. Another potential application is a point and shoot device for direct measurement of beryllium on a surface. Accurate and timely detection, and monitoring of beryllium is critical to worker safety during deactivation

and decommissioning activities. Beryllium dust is a significant workplace hazard. Exposure to beryllium particles can cause a serious illness in certain people. This illness is chronic beryllium disease, or CBD—an irreversible and sometimes fatal scarring of the lungs. Beryllium metal has been produced for various industrial uses, and was widely used in aerospace and defense applications. The baseline method for beryllium analysis is sending samples to an off-site laboratory, which takes days or weeks to get results. The Rocky Flats Environmental Technology Center (RFETS), Oak Ridge, Y-12, LANL, and the DOD have beryllium issues.

Status and Accomplishments: A contract was awarded to Science Engineering and Associates (SEA) to develop a Technology for Real-Time Measurement of Airborne and Surface Beryllium on September 30, 2000. The contractor has been working to establish lines of communication with RFETS, which is where demonstration of the instrument is planned. Following minor revisions to the Scope of Work, a subcontract was issued to Lovelace Respiratory Research Institute (LRRI). Under this subcontract LRRI will prepare various beryllium on filter samples for SEA, provide laboratory space at the LRRI facility for SEA's to conduct LIBS measurements of beryllium filters, and provide consultation related to the design of the beryllium monitor.

Current Reporting Period Activities: SEA has resolved all of the issues necessary to be able to obtain beryllium-contaminated samples from Rocky Flats and have them sent directly to Lovelace Lab. Discussions were held with Rocky Flats about the types and numbers of samples that SEA requires to conduct their instrument development. They remain very enthusiastic about supporting SEA's needs and are proceeding with the process of obtaining samples for them. SEA has sent a letter to Rocky Flats formally requesting samples. Also, discussions have been held with Rocky Flats regarding their needs for, and probable utilization of, a real-time beryllium monitor.

The SEA design staff held the first design meeting. In this meeting, the conceptual design for the prototype monitor was defined. Slight refinements to the conceptual instrument design were made to incorporate the input from the Rocky Flats technical contacts. Several critical design decisions were made during this reporting period. Selections were made for a number of the major components for the prototype instrument.

Various LIBS components from a previous R&D contract were removed from storage to be used for the laboratory LIBS system in the method development testing. These include a Continuum, Surelite I-20, 400 mJ Nd:YAG laser, an Acton Research SpectraPro®-750 0.75 m spectrograph, and a Princeton Instruments PG-200 time-gated photodiode-array (PDA) detector. Initial inspection of the laser revealed a damaged pocket cell heater board. A replacement board was procured and installed, returning the laser to normal function. The interface card for the detector was installed in a computer and the detection system tested using a mercury calibration light source. A hardware set, to position the test filters and provide a double containment system for the method development testing, was designed and fabrication of the set was nearly completed in December.

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2.3 Facility Decontamination

High Productivity Vacuum Blasting System

Objective and Scope: The objective of this project is to improve the productivity and economics of existing vacuum blasting technology, which is used to remove radioactive contamination, PCBs, and lead-based paint and provides worker protection by continuously recycling the material and dust from the decontamination tasks. This work will focus on re-designing and improving existing vacuum blasting components, including blast head nozzles, ergonomic handling of the blast head by reducing its weight, brush-ring design, vacuum level regulator, efficiency of dust separator, and operational control sensors. The redesign is expected to enhance the productivity and economy of the vacuum blasting system by at least 50 percent of current vacuum blasting systems.

LTC Americas will develop the necessary mathematical models of air-particle flow in the nozzle, in the blast head and interface area, and in the dust separator to study the flow characteristics and interaction of the various elements of the system. The purpose of this model development is to increase the productivity and economy of existing vacuum blasting technology by 50 percent. Based on the results of this modeling effort, the contractor will experimentally test and verify that the above system components perform according to the mathematical simulations and complete the preliminary design of the components of the proposed system. This will include an overall configuration of the system, including material selection and testing, definition of the range of dimensional and weight parameters, conceptual arrangement, or design of the blast head unit, and dust separator unit. Based on the preliminary design, the contractor will procure components, and perform fabrication and assembly of the proposed system.

The performance of the system will be evaluated in the laboratory mock-ups representing various cleanup situations and environments. The contractor will review, analyze, and interpret data collected from the tests and develop a productivity enhancement profile of the pre-prototype unit including economic analysis. Based on the laboratory test results, the contractor will modify, change, and make adjustments to enhance the capability of the system.

Status and Accomplishments: In Phase I, mathematical models and related code were developed to simulate the entire process numerically. Based on the data from the model, an innovative rectangular nozzle and a new centrifugal separator were designed, manufactured, and tested. The tests were performed to verify the mathematical models. The numerical results agreed with the measured data with a deviation within ten percent. Experimental results also showed that if the new innovative design rectangular nozzles replace the old circular nozzle, a more than 50 percent increase in productivity efficiency can be achieved. The newly designed centrifugal separator offers a high-efficiency separation increase from about 30 to 75 percent, even using finer abrasives.

During Phase II, the pre-prototype design of the improved high-efficiency vacuum blasting system was tested at Florida International University (FIU). The results demonstrated an improvement in productivity of 53 percent for concrete cleaning and 38 percent for steel plate over the original design.

The design and fabrication of a commercial prototype will be conducted during Phase III of the contract. During this phase of development, design features from the preprototype that hindered improvements in productivity will be removed. The heavy weight and poor handling characteristics of the nozzle head are examples of such features. This should lead to additional improvements in productivity.

Current Reporting Period Activities: The contractor has initiated Phase III by testing the nozzle configuration to determine its optimum angle with respect to the head assembly and vacuum line. The angle of the nozzle had been determined to be 45°. However, in the prototype tests, the nozzle head would not pick up debris on the backstroke when it was moved in both directions and the vacuum line was in front of the nozzle. Therefore, design and testing are being conducted to optimize its orientation.

For more information:

Tech ID 2224

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2.4 Facility Dismantlement and Material Disposition

Robotics Crosscutting Program

Objective and Scope: The Robotics Crosscutting Program (Rbx) supports the DDFA through technology development, close interaction with D&D Industry and University Programs funded through the National Energy Technology Laboratory (NETL), and introduction of new robotics technology into the DDFA's LSDDPs. Overall emphasis of the program continues to be design and integration of remote systems and capabilities used for facility deactivation and ongoing surveillance and maintenance activities with extended application to final facility D&D tasks. Deployment of remote D&D systems will reduce worker exposure to hazardous environments and provide productivity increases leading to substantial cost savings.

Status and Accomplishments: Rbx activities during FY2001 in support of DDFA will focus on the continued development of two remote systems: the Telerobotic Manipulation System (Tech ID 2181) and Telerobotic Control (Tech ID 2939). The Telerobotic Manipulation System was established as a project within the Rbx D&D product line as a new start in FY1999. From Rbx interactions with the Tanks Focus Area, there is a similar near-term need for a remote system to perform decontamination of pits associated with underground storage tanks at Hanford. Thus, the Rbx D&D activity was merged with the Rbx Tank Waste Retrieval (TWR) project for development of a prototype "Pit Viper" system. The Rbx D&D product line will assist in concept development and may provide operator console and Telerobotic controls technologies for use in the prototype. The long-term target for D&D deployment of this system is within Hanford's plutonium processing canyons.

The Telerobotic Control development activity addresses improved remote operation by providing advanced controls capabilities for remote manipulator systems. These advanced controls capabilities will increase effectiveness and efficiency of remote operation. This technology will be integrated with the Compact Remote Console (Tech ID 2180) and deployed within the Telerobotic Manipulation System.

Current Reporting Period Activities: Installation of the basic electrical/electronic components for the telerobotic compact remote console (CRC) was completed and functional testing has shown that all systems checkout and are operable. Debugging of the PC104 controller continued at the ORNL D&D Robotics Lab. Software development continued on the graphical user interface and additional error checking on the PC104-based Schilling controller in order to prepare for integration of various telerobotics capabilities early next year.

The hydraulic power unit of the Titan-II (T2) Schilling arm was verifed as working and connected to the arm. Since the T2 had not been run for a prolonged period, it was determined that it would be safest to first check out the arm using the commercial Schilling controller hardware prior to full startup of the arm with the PC104 controller. Several electrical problems were found with the T2. Repairs to the arm are necessary in order for the University of Tennessee at Knoxville to continue development and integration of their Robotic Task Space Analyzer (Tech ID 2171) with the T2. Repairs were completed including replacement of a servo valve and disassembly and cleaning of electrical wiring and connections.

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Tech ID 921

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2.5 Worker Safety and Other Projects

Protective Clothing Based on Permselective Membrane

Objective and Scope: Membrane Technology and Research (MTR), Inc., is developing and demonstrating improved protective clothing that provides protection equivalent to current garments, but is lighter weight to improve comfort and is breathable to allow water vapor to escape, therefore reducing heat stress. Improved protective clothing will be made of an innovative ultrathin, permselective outer membrane. The membrane is extremely permeable to water vapor escaping from the wearer, but highly impermeable to hazardous compounds. Fabric properties will be optimized and prototype suits will be tested during Phase I. In Phase II, 20-30 suits will be fabricated and used in a variety of extensive, comparative trials in the laboratory and at a non-hazardous site.

Status and Accomplishments: Development of fabric materials and laboratory tests on the fabric has been completed. In laboratory tests, water vapor transmission rates of 600x900 g/m2/day have been measured through the fabric. This water vapor transmission rate is far superior to butyl rubber suits with a water vapor transmission rate of 0x10 g/m2/day. Chemical vapor transmission rates have been equal to or lower than the fabrics of commercial suits.

Uretek laminated two rolls of the fabric. One roll of fabric (90 m by 30 in.), MTR1, uses rip-stop nylon as both inner and outer layers, and the second roll (40 m by 30 in.), MTR2, uses the rip-stop nylon on the outside and a flexible, lightweight, non-woven fabric on the inside. The prototype suits manufactured by Kappler Systems received the following tests by outside laboratories: chemical permeation, physical properties, sweating mannequin, and heat stress modeling. In general, the results are not as good as expected; although the fabrics do combine water permeability and reduced heat stress with chemical protection, neither the chemical permeation resistance nor the reduction in heat stress was as high as hoped. The economic analysis was updated based on this new data. The analysis shows that MTR1 provides the greatest benefits in productivity; however, the benefit does not appear to justify the higher cost of the suit made of this fabric. MTR2 fabric has less productivity benefit and a higher selling price, and so is less attractive than MTR1.

The Phase II permselective garment testing by the International Union of Operating Engineers (IUOE) was concluded in August 1999. The garments tested, for personnel comfort, and well-being of the worker while performing work, were those assembled by MTR's potential commercialization partner from the permselective fabrics supplied by MTR, Tyvek, and non-breathable garments like Saranex. The garments were all full bodysuits with hoods (for comparison purposes), and contained a more spacious cut in the chest and waist/crotch area than other manufactured garments, and this was very noticeable and appreciated by the test personnel. This also helped the garments to be more durable. Examples of tasks performed include crawling through confined spaces, performing metal grinding, and load-ing and hauling material in a wheelbarrow. The MTR garments, in general, were as comfortable, with respect to heat-stress, as the Tyvek garments, and extremely so, over the non-breathable garments. The test personnel all had very good comments concerning the MTR garments.

Current Reporting Period Activities: MTR and their potential commercialization partner received the final IUOE report on the permselective garment testing in November 2000. Communications have been initiated (November 2000) with the potential commercialization partner on the report and

An innovative fabric combines an ultrathin, permselective outer membrane with a sorptive inner layer.

where they will all go from here. The MTR portion of the economic analysis was initiated during September 2000.

The schedule is expected to continue to slip while the potential commercialization partner determines what they will or will not do in regard to commercializing the permselective membrane garment materials. MTR continues to work on the final economic analysis.

For more information:

Tech ID 95

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Integrated D&D Decision Analysis Tool

Objective and Scope:: The objectives of this work are to develop a computer-based Survey Module, update the existing computer-based Decontamination and Decommissioning Technology Database Module, integrate the Survey Module and the D&D Technology Module, and distribute the integrated software. FedTech, Arrey Industries, NES, and Research Triangle Institute have teamed to accomplish this effort. The existing D&D Technology Database Module being updated under this task was developed under a previous contract with Arrey Industries, NES, NEXI and Research Triangle Institute. The Survey Module will be able to cost effectively assist in preparation and execution of plans for initial facility surveys, operational surveys during D&D work and final facility release surveys. The Survey Module will estimate the budget, schedule, labor, radiation dose, waste generation, and equipment requirements to perform these surveys along with defining the number and location of survey points and recommended survey instruments. The Survey Module will integrate the collection, storage, and reporting of survey data.

Status and Accomplishments: This project is closing out and a final report is being created.

Current Reporting Period Activities: No activity to report.

For more information:

OST/TMS ID 173

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Modular Manipulator for Robotic Applications

Objective and Scope: This project focuses on the needs of Automated Plutonium Processing (APP) tasks that involve the manipulation of plutonium containers and the transfer of their contents. Specific challenges of APP gloveboxes include restrictive entry ports, confined workspace, limited maintenance access and destructive plutonium particulates, which make this task virtually impossible to automate with existing technology.

In order for automation systems to be successful within DOE facilities, they must provide maximum functionality, flexibility, ease of use, and reliability, while facilitating the rapid deployment of each custom system. This work concentrates on in-depth design and deployment of self-contained actuator modules, which will be used to construct a robotic manipulator tailored for APP tasks. A human-scale manipulator will be built from two sizes of DISC Actuator and will replace existing human labor within plutonium gloveboxes. The modular nature of ARM Automation's technology readily enables installation and maintenance of automation within "hot" boxes.

Status and Accomplishments: A survey of the state-of-the-art modular manipulators design is completed. This survey addresses modular manipulators developed inside government laboratories, universities, and private industry for such applications as space exploration or control research and commercially viable industrial applications. Based on this study, it is possible to define the requirements of one manipulator system

that can be used to conduct automated transfer operations within plutonium gloveboxes and some D&D applications.

Current Reporting Period Activities: The test plan for the testing the manipulator at ARM's facility was initiated. This effort included determining the best manipulator configuration to fit in the glovebox. A solid model of a glovebox was obtained from Sandia National Laboratory to aid in this effort. The integration of the subcomponents is delayed due to the problems of the controllers and the software. The University of Texas (UT) effort on the tele-operational environment for the manipulator is also just about complete. UT is presently packaging up its software to be passed off to ARM for implementation within Cimetrix. The UT effort on the obstacle avoidance implementation is also complete and is being packaged with the tele-operational software. ARM Automation is evaluating various DOE sites for the integrated testing of the system. The interested sites are LANL and ORNL. It is expected that the final test site will be selected by the end of January 2001.

For more information:

Tech ID 2199

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3.0 Programmatic Structure and Organization

The Office of Science and Technology (OST), as part of DOE's Office of Environmental Management (EM), manages a national program to conduct basic and applied research, and technology development/demonstration/deployment that is essential to completing a timely and cost-effective cleanup of the DOE nuclear weapons complex. OST provides environmental research results, as well as cleanup technologies and systems to meet EM program high priority science and technology needs while reducing technological risks and cost of implementation of effective solutions. The OST works closely with both the Office of Site Closure (EM-30) and the Office of Project Completion (EM-40) to accomplish its mission.

To achieve a comprehensive, integrated approach to developing and providing science and technology solutions, EM has separated the site cleanup needs into a set of five problem areas. A Focus Area has been established to plan and manage EM's research and development investments to develop solutions to each of these five problem areas:

- Deactivation & Decommissioning Focus Area
- Tanks Focus Area
- Nuclear Materials Focus Area
- TRU and Mixed Waste Focus Area
- Subsurface Contaminant Focus Area

In addition, three crosscutting technology areas were established where technology needs and targets are relevant to more than one Focus Area:

- Characterization, Monitoring and Sensor Technology (CMST)
- Efficient Separations and Processing (ESP)
- Robotics

The Industry Program conducts competitively selected activities that involve the private sector in developing, demonstrating, and implementing improved technologies that address the needs of the focus areas and the crosscutting areas.

The result of this structure of programs is that the D&D Focus Area is positioned to support those research areas defined as highest priority by EM-50 and DOE customers.

The Role of NETL

The Federal Energy Technology Center, with physical sites in both Pittsburgh, Pennsylvania and Morgantown, West Virginia, was redesignated by U.S. Secretary of Energy Bill Richardson, as the National Energy Technology Laboratory (NETL). As the 15th national laboratory, NETL becomes part of the national laboratory research system. This is the largest research system of its kind in the world with more than 30,000 engineers and scientists conducting research and research and leading-edge experiments. As part of this system, the new National Energy Technology Laboratory will join Argonne National Laboratory (Illinois); Brookhaven National Laboratory (New York); Lawrence Berkeley National Laboratory (California); Fermi National Accelerator Laboratory (Illinois); Idaho National Engineering & Environmental Laboratory (Idaho); Lawrence Livermore National Laboratory (California); Los Alamos National Laboratory (New Mexico); National Renewable Energy Laboratory (Colorado); Oak Ridge National Laboratory (Tennessee); Pacific Northwest National Laboratory (Washington); and Sandia National Labo-ratories (New Mexico and California).

Rita A. Bajura, NETL Director, a career federal executive with more than 18 years experience in government-industry energy partnerships, continues in her leadership position as head of the single management team that serves both physical sites with a combined working force of more than 530 federal scientists, engineers, and administrative staff. NETL is responsible for nearly 600 research projects; most involving the development of advanced fossil fuel technologies.

In addition to the new national laboratory's core capabilities, Secretary Richardson announced that a newly created Center for Advanced Natural Gas Studies, would be an integral part of NETL's research endowment.

Senator Robert C. Byrd, (WV) remarked in the course of the dedication that, "Much of the laboratory's work is dedicated to the worthy goal of developing innovative, clean and efficient technologies that will allow our nation to meet its growing energy needs. As

the nation's newest national laboratory, it will continue to help light a pathway for a new era of energy use that will ensure a comfortable standard of living for our children and our children's children."

NETL also manages a significant portion of the technology development needed to clean up sites in the government's nuclear weapons complex. In February 1995, the then Morgantown Energy Technology Center was selected by EM-50 to be the implementing organization for the D&D Focus Area. As such, it brought the experience gained from being the implementing organization for the Industry Program, which competitively selects industrial R&D performers through Research Opportunity Announcements (ROAs) and Program Research and Development Announcements (PRDAs). As the lead organization for D&D implementation, NETL is responsible for the planning, monitoring, and evaluating RDDT&E pro-jects to meet the requirements of EM-50 and its customers in EM-30.

▼Stakeholder Feedback

The stakeholders in the D&D Focus Area include DOE headquarters; DOE operations offices; DOE sites and their operating contractors; D&D technology developers and users in the private sector; federal, state, and local regulators; and the communities around affected DOE facilities. These stakeholders have been providing input to focus area planning and implementation; program contacts are provided on the first page of this report.

"It's time we elevate the profile and prestige of this world-class facility, which has been helping solve energy and environmental problems for more than 50 years,"

Bill Richardson, U.S. Secretary of Energy, National Energy Technology Laboratory Dedication Ceremony

4.0 Background

The D&D Focus Area was established to develop and demonstrate improved technologies and systems that could solve customer-identified needs to characterize, deactivate, survey and maintain, decontaminate, dismantle, and dispose of or recycle DOE surplus facilities and their contents. The mission also includes facilitating the acceptance, approval, transfer, commercialization, deployment, and implementation of these technologies and systems.

These technologies are needed to address the pressing needs of deactivating more than 7000 contaminated buildings and decommissioning more than 700 buildings. In addition, material disposition is required for over 600,000 tons of metal and 23 million cubic meters of concrete in contaminated buildings and for 400,000 tons of metal currently in scrap piles. The major drivers for this focus area are the high safety and health risks associated with working in aged and contaminated facilities and the high costs associated with facility deactivation, sur-veillance, and maintenance using currently available baseline technologies.

D&D Focus Area Strategy

Subsequent to the selection of NETL as the lead organization for the D&D Focus Area, a program review of all FY95 projects was held in May 1995. Based on this and other recent program reviews, as well as the general requirement for fiscal constraint throughout, the following strategies were developed:

Programmatic Strategy

- Focus D&D technology development program on large-scale demonstrations emphasizing full-scale demonstrations using a suite of improved technologies.
- Demonstrate technologies only through large-scale demonstrations.
- Focus on technologies that are identified as high priority by customers, that have wide applicability, and that have a commitment to be considered for use by customers.
- Emphasize demonstration and deployment of private-sector technologies.
- Technical Strategy

In the near term, emphasize technologies to effectively support:

- deactivation of facilities,
- decontamination of surfaces,
- reuse of bulk contaminated materials,and
- application of remotely operated dismantlement systems

In the middle term, emphasize technologies to effectively support:

- applications of remote surveillance systems,
- characterization of volumetrically contaminated materials,
- decontamination of bulk materials, and
- adoption of release standards for bulk contaminated materials.

Large-Scale Demonstrations and Deployment Projects

A cornerstone of the D&D Focus Area is its series of large-scale demonstration and deployment projects. The LSDDPs demonstrate innovative and improved D&D technologies at full scale, side by side with existing commercial technologies. The intent is to compare benefits from using a suite of improved and innovative D&D technologies against those associated with baseline D&D technologies. This approach provides an opportunity to test improved and innovative D&D technologies at a scale that will provide meaningful cost and performance information to the potential end-users of the technology.

5.0 Upcoming Events

April 2001

DDFA Midyear Review and Decommissioning Symposium Florida International University

April 17-19, 2001
Conference Center, North Campus
Miami FL

American Nuclear Society (ANS) 9th International High-Level Radioactive Waste Management Conference (IHLRWM)

April 29–May 3, 2001
Las Vegas, NV

June 2001

American Nuclear Society Annual Meeting

June 18–21, 2001
Milwaukee, WI

September 2001

American Nuclear Society Decommissioning, Decontamination & Reutilization Meeting

September 23–27, 2001
Knoxville, TN

November 2001

American Nuclear Society Winter Meeting

Nov. 11–15, 2001
Reno, NV

We list conferences and workshops of interest to our readership. Please let us know if you would like us to include your event on this page.

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